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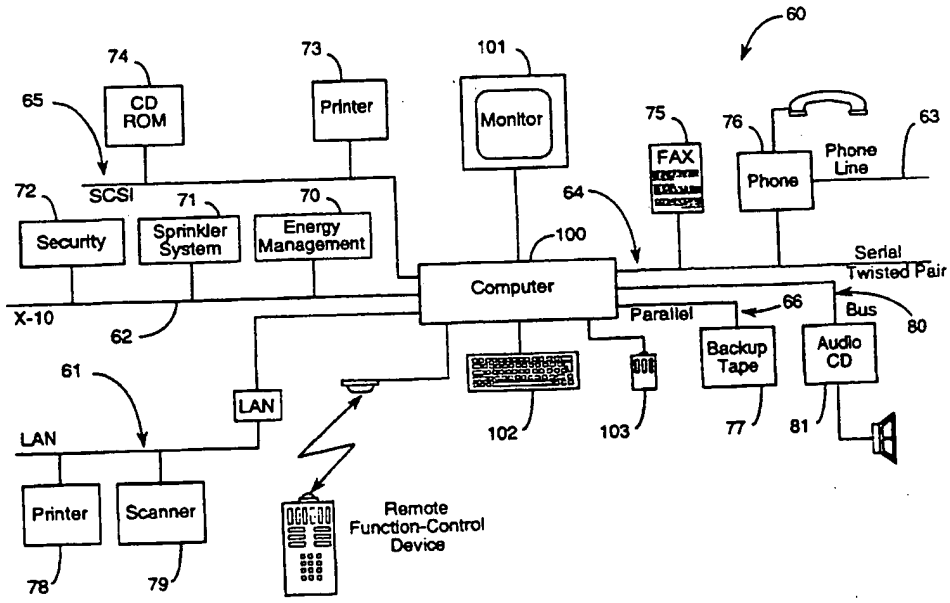

(57) Abstract

A system for controlling computer peripherals is based on a hand-held remote control device (13) with input operators (31, 35, for selecting a peripheral to control and for registering commands and data to effect the desired control. The hand-held remote contro (13) transmits to a receiver (12) at a computer (100), and the computer, executing unique control routines, sends commands and based on the input from the remote (13), to a communication port connected to the peripheral device (70-79, 81) to be controlled. In embodiment, the computer also displays control information on a video display (101) connected to the computer.

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Remote Function-Control System for Computer Peripherals

Field of the Invention

The present invention is in the area of remote control of functions of electronic devices and is particularly relevant to control of the functions of computer peripherals used in homes and offices.

Background of the Invention

It is common to control many sorts of electronic devices by a computer. For example, most modern personal computers are equipped with a telephone modem for electronic data transfer, and many modems are fax modems as well. Printers, scanners, CD-ROM drives, and the like are other sorts of electronic devices commonly connected to, and controlled by, a computer. Such devices are often termed computer peripherals in the art.

Other sorts of electronic devices, such as stereo sound equipment, audio CD drives, television sets, and the like are less commonly computer connected and controlled. Still, there is no good reason why they should not be, and in many instances, such devices are computer connected and controlled, although they are less likely to be computer resident, that is, installed in the same case as the controlling computer.

There are still other uses for computer control. For example, a homeowner or resident may wish to connect lights, temperature, energy usage, a sprinkler system, or a home-security system to a computer, and control the functioning of such equipment from one or more personal computers. In this broader sense, any and all sorts of electronically controlled or controllable equipment may be thought of as computer peripherals.

Computer control of peripheral devices typically involves an interactive video display interface through which a user (operator) selects functions, enters values for variables, and issues commands. The actions and data an operator enters at a display interface are typically transmitted to an I/O interface at the peripheral device to be controlled, where the signals are used to actuate and manipulate such as motors, switches, and solenoids to effect the desired response.

A serious problem with controlling peripheral devices in this manner with a computer through an interactive video interface, whether the devices are resident or remote, lies in the fact that the interaction one must effect is behavior well-known to the computer literate portion of the population, but not well-known or familiar to the larger population that is not so computer-friendly. This conventional control process is a repetitive and time-consuming process. To select, access, and configure a peripheral device, a user must press various keys or move and click the mouse many times.

Another problem is that most personal computers are not adept at handling multiple tasks simultaneously. A running application must be stopped before a peripheral can be accessed. Consequently, the process of operating a peripheral becomes cumbersome. If there are several peripherals connected to, and controlled through, a single computer, the total load may be beyond the capability of the single computer.

Yet another problem is that the user must remain at the keyboard and near the video display to operate the peripherals. This is inconvenient, for example, when the user might wish to adjust home-environment parameters or use a computer-resident telephone dialing system.

What is clearly needed is a device more familiar to a larger population of potential users that provides mobility for the user. That

is, a device is needed that allows users simple and remote control of any peripheral that is connected to their computer as a controlled peripheral, without the drawbacks described above. Such a device might take the form of a small, portable (hand-held), self-contained unit much like a TV remote. The device would have a communications interface to the user's computer, and physical operators (buttons, switches, and the like, as with a TV remote) that initiate signals to send data and commands to the user's computer system. Computer-resident function-control software then may provide translation to the signals needed to go to a peripheral to affect control, and an informational video display for reporting the result of control activity.

Summary of the Invention

In a preferred embodiment, a system is provided for controlling a peripheral device connected to a computer, comprising a computer having a receiving interface for receiving coded data, a CPU, a memory, peripheral function control routines stored in the memory, and a peripheral communication port. The remote control device has input operators, transmission apparatus for sending coded signals to the receiving interface, and a controller for coding inputs from the input operators and transmitting the codes to the communication interface. The remote control device receives input from the input operators representing commands and data to control a computer peripheral device, codes the input, and transmits the input to the remote communication interface, and the CPU in the computer, executing the peripheral function control routines, selects a peripheral to be controlled, and prepares and sends data to the peripheral communication port according to the commands and data received

from the remote control device.

In various embodiments the peripheral communication port is one of an expansion slot connected to an expansion bus of the computer, a small computer system interface (SCI) port, a standard serial port (SAP), a standard parallel port (SPP), or a local area network (LAN) port. The transmission may be an infrared transmission apparatus, or any of various other transmission systems, including a serial communication link connected to a serial port at the computer.

The system of the invention enables a user to operate peripherals connected to the computer in a manner that is familiar to many more people than are familiar with computer operations, with an input interface that is very user-friendly and intuitive. In some embodiments, the computer also displays control information and the results of control operations on the video display screen connected to the computer, and may display the information in large letters, so a user is not constrained to be near the computer video display screen for control operations.

Brief Description of the Drawings

Fig. 1 is a mostly block diagram of a remote function-control system in an embodiment of the present invention.

Fig. 2 is a plan view of a hand-held remote-control device according to an embodiment of the present invention.

Fig. 3 is a logic flow diagram representing steps performed in executing a computer-resident function-control program according to an embodiment of the present invention.

Fig. 4 is a logic flow diagram depicting steps in operation of a

control routine that allows a user to edit, add and remove macros and to select to display a function-control icon.

Fig. 5 is a logic flow diagram describing a control routine that starts the function-control program.

Fig. 6 is a block diagram that illustrates a remote function-control system with various configurations for computer-to-peripheral connections.

Description of the Preferred Embodiments

General Description

Fig. 1 shows a remote function-control system 11 for use in controlling peripherals according to an embodiment of the present invention. Remote function-control system 11 comprises a hand-held remote-control 13, a communication receiver 12, a computer system 14 having the well-known elements of such a computer system, including a CPU, a memory, and a communication bus, as well as a keyboard 83 and a pointer device (mouse) 82, a function-control program 10 stored in a memory 9 of computer system 14, a function-control icon 15 displayed on a video display 8 of the computer system, a computer-resident peripheral 16, and a remote peripheral 17. Mouse device 82 controls a screen pointer 84 as is well-known in the computer arts. The keyboard is used for input as is also well-known.

Resident peripheral 16 is meant to represent any of a range of peripheral devices that might be installed within the computer system's enclosure. Such devices include hard disk and floppy drives, sound cards, CD-ROM drives, and the like.

Remote peripheral 17 is meant to represent any computer-controllable peripheral remote from the body of computer system 14, but which may be connected to the computer system by a communication link, such as a serial, parallel, SCSI, or network link, among other possibilities. To be controllable by the computer system it is understood that a remote peripheral must include an I/O interface capable of receiving electronic commands and data from the computer system, and elements capable of manipulating functions of the peripheral device in response to the commands and data received from the computer.

Remote peripherals, as described above represented by remote peripheral 17, include a broad range of electronic devices such as televisions, stereo equipment, door openers, light switches, and the like, and may include virtually all equipment which may be interfaced to a computer communication link in a manner to control functions of the equipment by signals received from the computer system. In many cases, the communication may be two-way, with the remote peripheral sending status signals back to the computer via typically the same link over which the computer system sends control signals and data.

Those with skill in the art will recognize that computer control of both computer-resident and remote peripherals having I/O interfaces, is old in the art, and that this portion of the present invention may be implemented with little difficulty by those with skill in the art, using well-known equipment and techniques.

Fig. 2 is a plan view of a hand-held remote-control device 13 according to an embodiment of the present invention. Hand-held remote-control 13 comprises, but is not limited to, a communication transmitter 33, a first keyset 31 for providing a signal to select a particular peripheral, a second keyset 35 for providing control signals

for a peripheral device selected by keyset 31, and a third keyset 36 to enter numeric data such as a telephone number or a number of pages to be printed. The remote control device has a controller 88 for managing operations, such as coding signals received from keys in the keysets, and for transmitting the coded signals via communication transmitter 33.

A peripheral or a function is selected either by pressing a single key, or, in some cases by pressing simultaneously or sequentially multiple keys. The keys shown in Fig. 2 are pushbuttons, well-known in the art, but operators on a remote control device as disclosed herein need not be limited to pushbuttons. Many other sorts of input devices are well-known, such as rotary potentiometers, slide potentiometers, touch screens, and the like. Fig. 2 represents an embodiment, an example, and in other embodiments, other sorts of input operators might be preferred.

It is well-known to the inventors and in the art in general that there are many commercially available remote devices with communication interfaces (such as infrared interfaces), and that many sorts of devices (VCR's, TV's, stereo receivers) may be controlled directly by such devices. Such commercially available remote control units may well be incorporated in some embodiments of the invention.

In operation of remote-control device 13, the state of each activated key is converted to digital data and encoded on a carrier. It will be apparent to those with skill in the art that the method of conversion includes but is not limited to analog-to-digital conversion, and that the method of encoding includes but is not limited to dual-tone multi-frequency (DTMF) encoding, amplitude modulation, or frequency modulation of a carrier wave. The communication mode of many remote-control devices is infra-red, and infra red encoding and communication is a useful mode in some embodiments of the

present invention. In other embodiments the communication mode might be ultra-sound, magnetic inductive, RF, FM, AM, Sb, or SBC, among other possibilities.

To accomplish a change-of-state for a particular peripheral from hand-held remote-control device 13, an operator presses the appropriate key of keyset 31. This operation sends a signal to the computer which selects the particular peripheral. Selection, in this sense, amounts to diverting or directing execution of control routines by the CPU of the computer to a specific sequence in function-control program 10, which recognizes following operations at the remote device to be directed to that peripheral.

Once a peripheral is selected, pressing one or more of the keys of key set 35 sends signals to the computer which the computer interprets, by virtue of the parts of control routines 10 being executed, as specific instructions to be prepared and sent to the selected peripheral. If numeric data need be entered, the key sequence may be continued by pressing one or more keys of key set 36.

Input data generated by hand-held remote-control device 13 may be transmitted from communication transmitter 33 to communication receiver 12 by various means, as was described above. It will be apparent to those with skill in the art that a carrier of data includes, but is not limited to, electric current, electromagnetic radiation (rf), light, or sound. And it will be apparent to those with skill in the art that the method of encoding data onto a carrier includes, but is not limited to, amplitude, frequency, pulsewidth, or dual-tone multi-frequency (DTMF) modulation.

When a coded signal arrives at communication receiver 12, the coded sequence is recovered, evaluated, and temporarily stored. Upon completion of a valid key sequence, an interrupt is issued directing the CPU to a specific portion of computer-resident function-control

program 10.

The preferred mode of operation in the present invention id for the computer CPU to prepare a macro and forward it to the appropriate peripheral. Such macros are more fully described below. For example, in the present embodiment of this invention, a user can, by just pressing a key on the hand-held remote-control, remotely activate a speaker phone to initiate a telephone call and simultaneously mute the sound of a running audio CD. Or a user can, by just pressing a key sequence on the hand-held remote-control, remotely set the temperature in a room.

Software Architecture

Fig. 3 is a logic flow diagram describing function-control program 10 (Fig. 1) according to an embodiment of the present invention. At step 21, the CPU of the computer system reads, validates, and interprets data from remote-control device 13 that arrives at communication receiver 12 (Fig. 1). If the data is valid, control proceeds at step 22 to interrupt any running application program. At step 23 a peripheral to be controlled is selected according to the information received from the hand-held remote-control, and control flow jumps to a control routine specific to the selected peripheral.

Once a peripheral is selected, such as a VCR, a FAX, or a TV as shown in the flow paths leading from step 23, following data from the remote-control device is interpreted as directed to that peripheral until another peripheral is selected.

Referring again to Fig. 2, showing the remote-control device, keyset 35 has keys for sending signals for a selected peripheral to perform certain functions. A volume key 85, for example, is a

double-ended key, such that pressing the + end increases volume for a peripheral, such as a TV, that has a volume control. Pressing the - end sends a signal to decrease the volume. On-off key 86 is self-explanatory, as are the other keys, given the example of key 85.

Assuming the VCR has been selected, control goes to step 24a, and a pre-recorded macro for the VCR is selected, prepared, and sent to the VCR. At step 25a, the macro is executed at the peripheral device, accomplishing the function selected from keyset 35, which may include data entered at keyset 36.

If the TV is selected a macro is prepared at step 24b. If the fax is selected, a macro is prepared at step 24c, and execution in these cases is accomplished at steps 25B and 25C respectively. There may well be other connected peripherals.

A macro, according to various embodiments of the invention, is basically a set of commands and data statements in "C", Pascal or other computer language that controls functions of a specific peripheral. Macros may be in almost any computer language in various embodiments, including assembly language. Since a macro is often unique for a kind or brand of peripheral, it is a big advantage for embodiments of the present invention to use prerecorded macros that are stored and retrieved by the CPU executing the function-control program.

In some embodiments of the invention, an on-screen interface at the computer is provided to enable users and/or maintenance personnel to add, edit or remove macros. Such a pop-up menu is more fully described below.

At step 26, in some embodiments, a message is displayed on the computer system's video display to indicate whether or not the function has been successfully executed. To allow the user to observe the message from a distance, it may be displayed using large

characters. Also, a message may be announced with a computer generated voice or sound, or graphic displays may be used, as is known for volume control and the like.

The function-control program terminates at step 27, removes messages from the video-display, sets default values for all function-control variables, and allows the interrupted application program to continue.

Fig. 4 is a logic flow diagram representing a control routine that enables a user to edit, add, and remove macros, or to remove the function-control icon 15 (Fig. 1) from the screen of the video display. To add, edit or remove a macro, the user uses mouse 82 to move pointer 84, and clicks at step 40 on the function-control icon. This point-and-click sequence is well-known to those with skill in the art. As a result of this icon activation, a pop-up menu 41 appears.

Pop-up menu 41 in this embodiment contains several named option fields such as edit macro 41a, add macro 41b, remove macro 41c, remove icon 41d, and exit 41e.

Clicking on "edit macro" option 41a causes a window to appear that enables the user to review and edit an existing macro. The window may take one of a number of forms, as known in the art, having editing fields and a text cursor, as well as function "buttons" such as Cancel and Save. One enters the text fields, and through the keyboard, edits the program statements as desired. A knowledge of the language used is, of course, essential, and this editing feature may be made available only to authorized personnel.

Through selection 41b of menu 41, a user accesses another window, similar to the edit window, wherein the user may compose a new macro for the system.

When a macro has been added or modified, a program routine, comprising step 45 and step 46, stores the macro for future use.

Clicking on "add macro" 41b or "remove macro" 41c causes a window to pop up that requests the file name of the targeted macro. Clicking on the "remove icon" option 41d starts execution of a control routine, comprising step 42, step 43, and step 44, that terminates the function-control program and removes the function-control icon from the video display screen.

Fig. 5 is a flow diagram representing a startup routine that starts up the function-control program according to an embodiment of the present invention. It will be apparent to those with skill in the art when and how this program routine is executed. At step 51 all available stored macros are loaded. At step 52 an initialization routine is loaded that when executed, presets at step 53 all relevant peripheral variables to default values. At step 54, all hardware is tested. That is, the initialization routine searches for peripherals that exist in the system. If the initialization routine finds a peripheral, it records its type, brand and place in the system. If at step 55 no problems are found with the hardware, the initialization routine places function-control icon 15 (Fig. 1) on the monitor screen. If a problem with a peripheral or is detected, function-control program is removed at step 57 and an error message is placed on the video display screen at step 58.

Fig. 6 illustrates another remote function-control system according to another embodiment of the present invention. Remote function-control system 60 includes, but is not limited to, a computer 100 with a video display 101, a keyboard 102, and a mouse 103. There are computer-to-peripheral interfaces such as a LAN (Local Area Network) 61, an X-10 (ac-line communication) system 62, a serial link (twisted pair) 64, a SCI (Small Computer System Interface) 65 using twisted pairs of wires, a parallel communication link 66, and an expansion bus 80. It will be apparent to those with skill in the art

which kind of interface system to use for a particular device, and it will be apparent to those with skill in the art which communication software to use for that device.

For example, since energy management peripherals 70, sprinkler system peripherals 71, and security system peripherals 72 are controlled at low data rates, they communicate with computer over ac power wiring. Peripherals such as printer 73 and CD ROM 74 that require high data rates and are in the local vicinity of a computer may be best served with a Small Computer System Interface. by SCI bus 65. Peripherals such as a FAX 75 and a smart telephone 76 may be best connected by serial link 64. Parallel link 66, for example, may be used to connect a peripheral such as a backup tape recorder 77, and computer system expansion bus 80 may be used to connect, for example, an audio CD peripheral 66. Remote peripherals such as printers 78, scanners 79 or even another computer system may communicate with the computer over LAN 61.

It will be apparent to those with skill in the art that there will be many alterations that might be made in the embodiments of the invention described herein without departing from the spirit and scope of the invention. There are more ways of communicating with peripherals than the ways described, for example. One might provide radio communication, including satellite communication, for such links. ISDN lines and optical cable technology might be used as well. As another example, different programmers might implement the control routines for the computer in different ways, and might provide windows of variant design. I/O interfaces may vary widely as well at the controlled peripheral devices. There are many more such alterations and deviations that might be made within the spirit and scope of the invention.

What is claimed is:

1. A system for controlling a computer peripheral, comprising:

a computer having a receiving interface for receiving coded data, a CPU, a memory, peripheral function control routines stored in the memory, and a peripheral communication port; and

a remote control device having input operators, transmission apparatus for sending coded signals to the receiving interface, and a controller for coding inputs from the input operators and transmitting the codes to the communication interface;

wherein the remote control device receives input from the input operators representing commands and data to control a computer peripheral device, codes the input, and transmits the input to the remote communication interface, and wherein the CPU in the computer, executing the peripheral function control routines, selects a peripheral to be controlled, and prepares and sends data to the peripheral communication port according to the commands and data received from the remote control device.

2. A system for controlling a peripheral device as in claim 1, wherein the peripheral communication port is one of an expansion slot connected to an expansion bus of the computer, a small computer system interface (SCI) port, a standard serial port (SAP), a standard parallel port (SPP), or a local area network (LAN) port.

3. A system for controlling a peripheral device as in claim 2, additionally comprising a peripheral device having a peripheral controller connected to one of the peripheral communication ports, and wherein the peripheral controller receives the data sent by the computer CPU to the peripheral communication port, and manages

functions of the peripheral device according to the data received.

4. A system for controlling a peripheral device as in claim 1, wherein the transmission apparatus is an infrared transmission apparatus, and the receiving interface is an infrared interface.

5. A system for controlling a peripheral device as in claim 1, wherein the computer has multiple peripheral communication ports.

6. A system for controlling a peripheral device as in claim 5, additionally comprising multiple peripheral devices connected to the multiple communication ports, the multiple communication devices comprising one or more of a CD-ROM drive, a printer, a home security system, an energy management system, a scanner, a television receiver and display, a fax machine, a telephone modem, an audio-CD, and a tape storage unit.

7. A system for controlling a peripheral device as in claim 1, wherein the CPU in the computer, executing the control routines, additionally causes messages to be displayed on a video display connected to the computer, the messages displaying selection and control information, and results of control operations.

8. A method for controlling a computer peripheral, comprising steps of:

(a) selecting a peripheral to be controlled and entering control commands and data at a remote control device having a controller and operators for making selections and entering commands and data;

(b) coding and transmitting the entered selection, commands, and data to a receiving interface at a computer having a CPU, a

memory, peripheral function control routines, and a peripheral communication port;

(c) preparing and sending commands and data to the peripheral communication port by executing the function control routines with the computer CPU.

9. The method of claim 8 additionally comprising a step (d) for displaying selection and control information on a video display connected to the computer.

10. The method of claim 8 wherein the peripheral communication port is one of an expansion slot connected to an expansion bus of the computer, a small computer system interface (SCI) port, a standard serial port (SAP), a standard parallel port (SPP), or a local area network (LAN) port.

11. The method of claim 8 additionally comprising a step (d) for receiving the commands and data at a peripheral device connected to the peripheral communication port and having a peripheral controller, and wherein the peripheral controller manages functions of the peripheral device according to the commands and data received.

12. The method of claim 8 wherein the transmission apparatus is an infrared transmission apparatus, and the receiving interface is an infrared interface.

13. The method of claim 8 wherein the computer has multiple peripheral communication ports.

14. The method of claim 13 additionally comprising multiple

peripheral devices connected to the multiple communication ports, the multiple communication devices comprising one or more of a CD-ROM drive, a printer, a home security system, an energy management system, a scanner, a television receiver and display, a fax machine, a telephone modem, an audio-CD, and a tape storage unit.

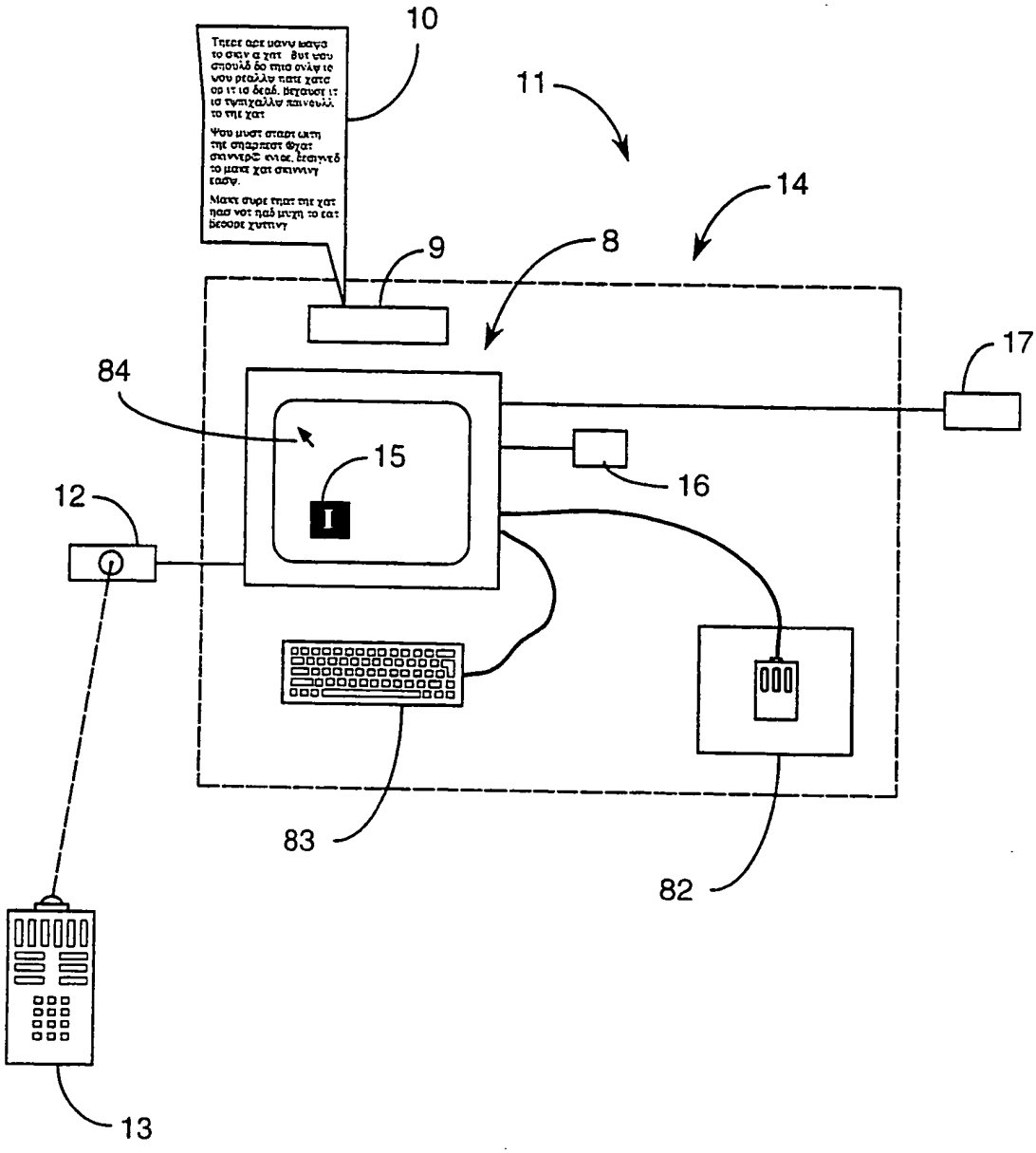

Fig. 1

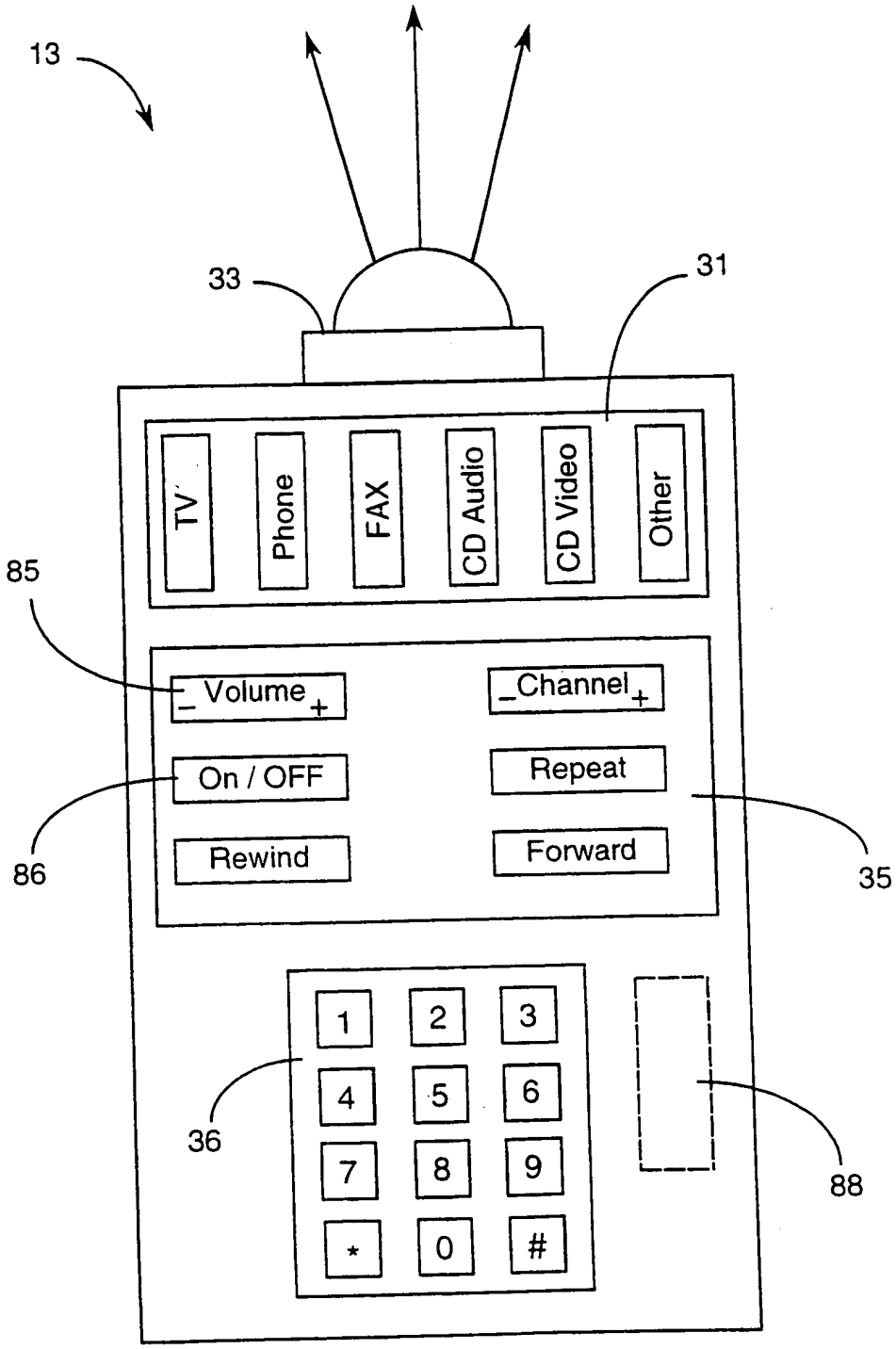
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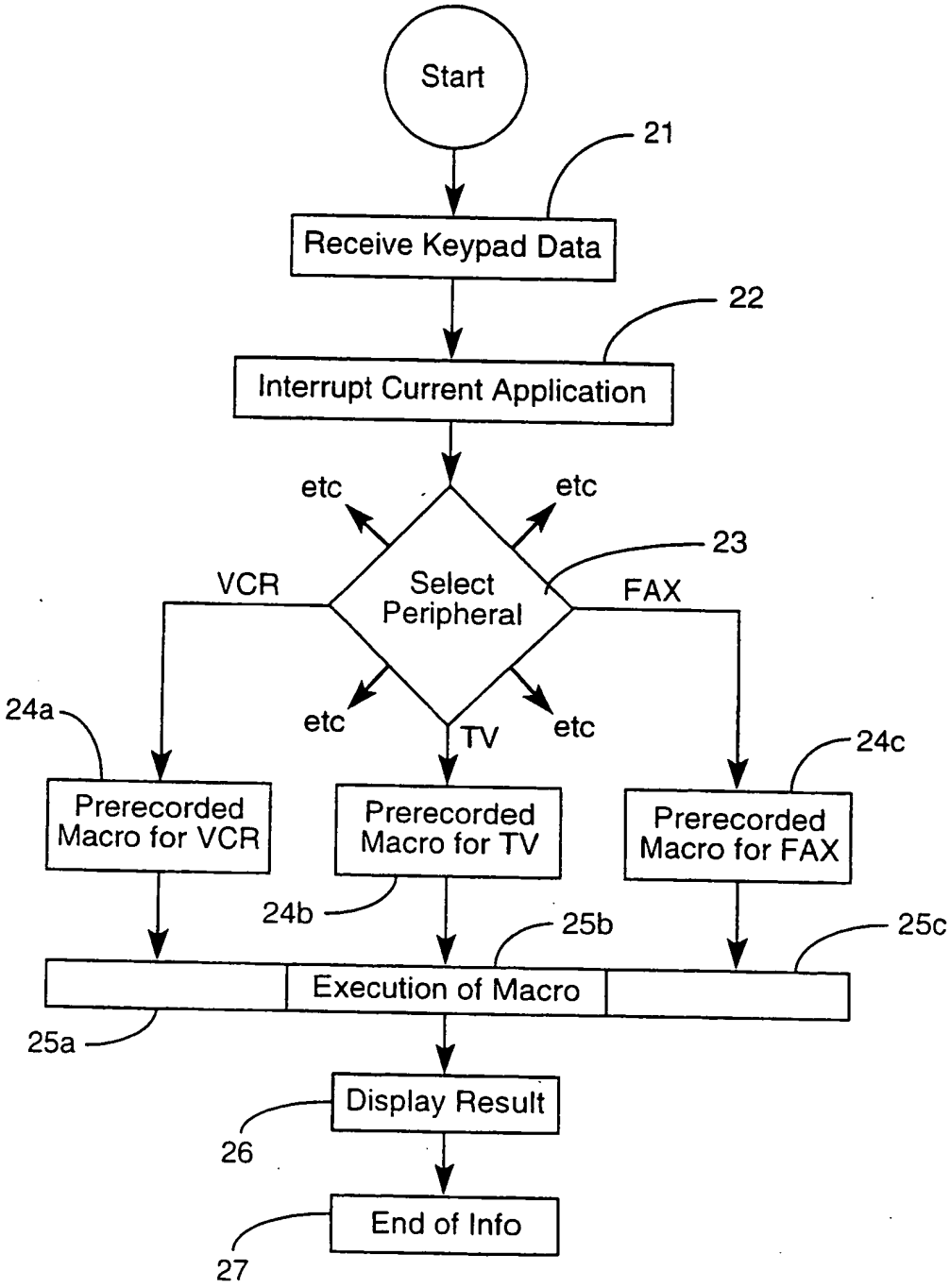
Fig. 2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FAX
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TV
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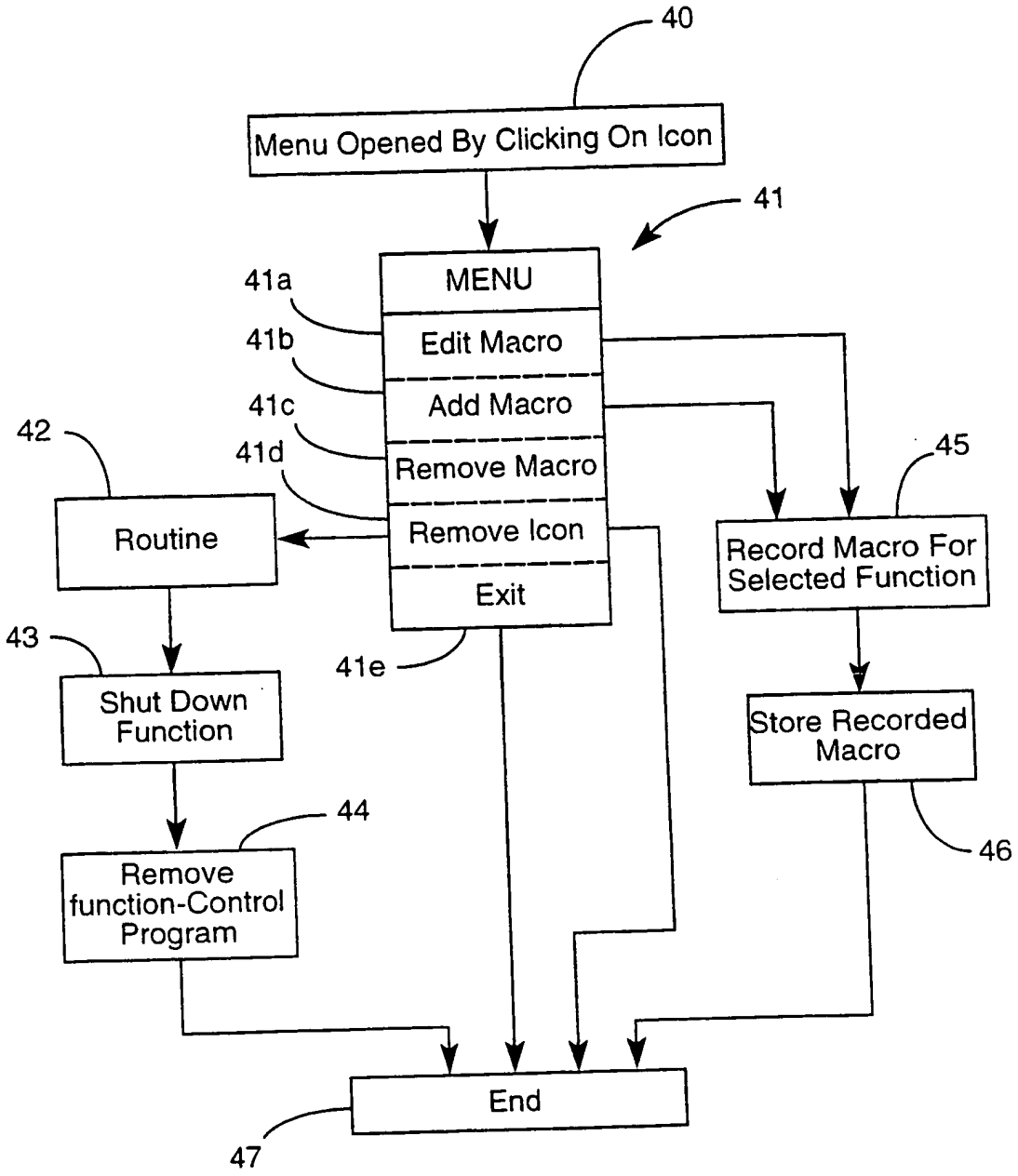
25b
25c
Execution of Macro
25a
Display Result
26
End of Info
27

Fig. 3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MENU
41a
Edit Macro
41b
Add Macro
41c
Remove Macro
41d
Remove Icon
Exit
41e
42
Routine
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Shut Down Function
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Remove function-Control Program
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Record Macro For Selected Function
Store Recorded Macro
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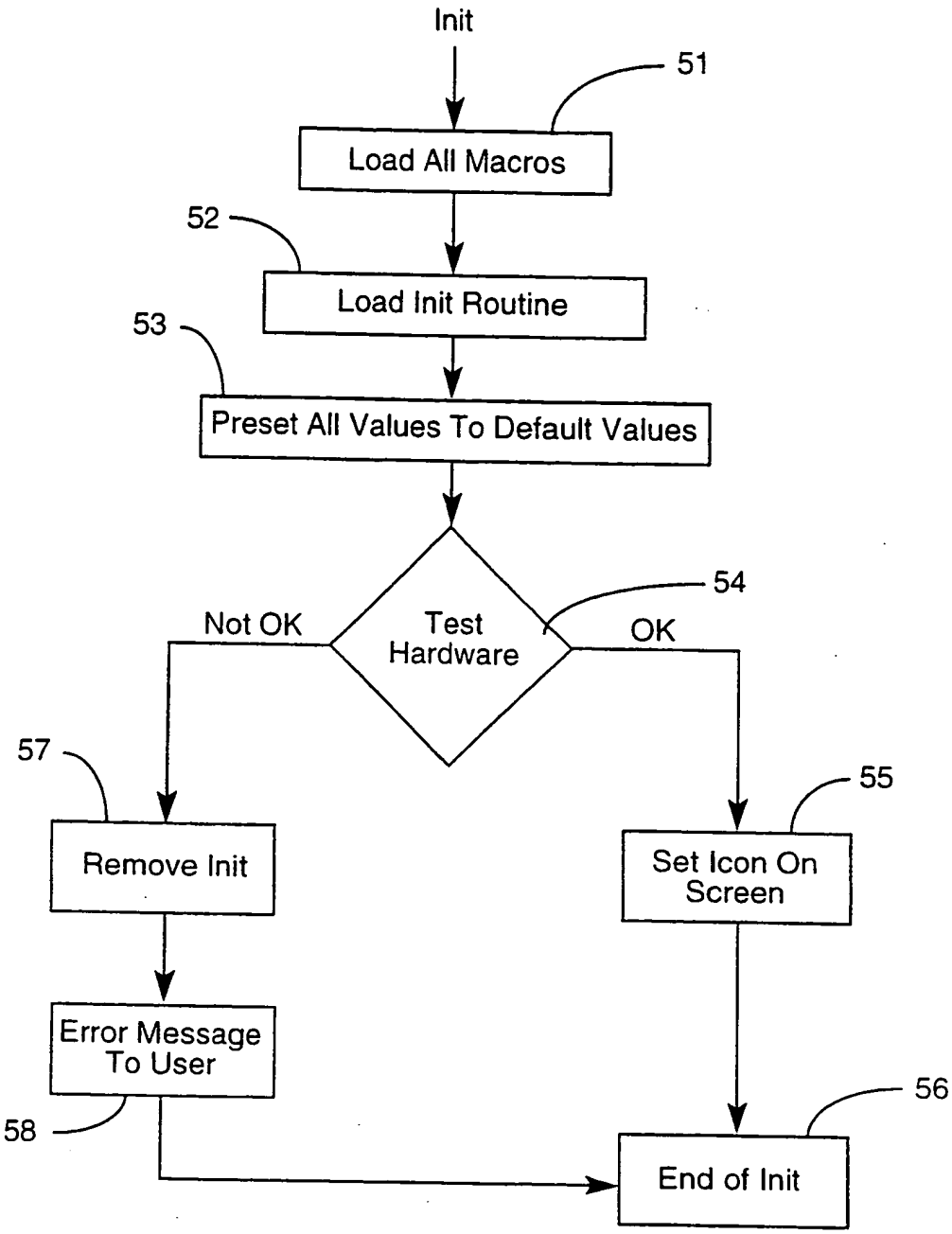
End
47

Fig. 4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Remove Init
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Error Message To User
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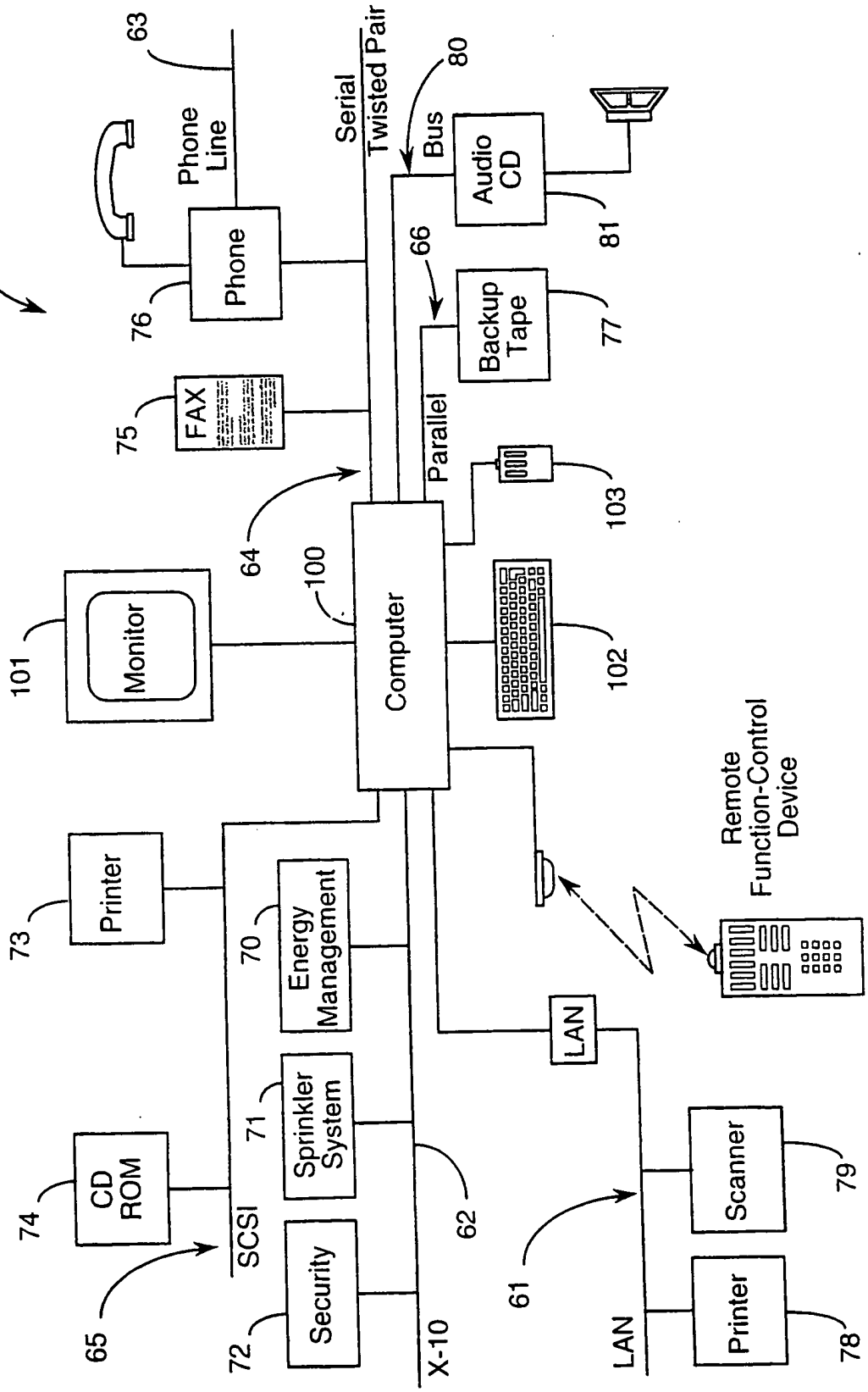
Fig. 5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Printer
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62
SCSI
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72
Security
X-10
61
Scanner
79
LAN
Printer
78

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/06226

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :G05B 15/02
US CL : 364/146; 340/825.72
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 364/146,140-145,147,188,189,400,420,492,493,505;340/825.72,825.69; 379/102,104; 359/148

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,086,385 (LAUNEY ET AL.) 04 FEBRUARY 1992, (04.02.92) Col.7, line 38 to col.10, line 36; col. 11, lines 34-53; col. 13, lines 47-66; col. 15, lines 1-12; col. 24, lines 11-29; and figure 1.	1-14
X	US, A, 5,204,768 (TSAKIRIS ET AL.) 20 APRIL 1993 (20.04.93) Figure 1; col.3, lines 59-68; col.5, lines 3-22; col.8, line 1 to col.10, line 32.	1-14
X,P	US, A, 5,500,794 (FUJITA ET AL.) 19 March 1996 (19.03.96) Figures 1,9; col.3, lines 12-55; col. 5, line 33 to col. 7, line 50.	1-14

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
13 JUNE 1996

Date of mailing of the international search report
15 JUL 1996

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Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/06226

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A,P	US, A, 5,418,527 (YASHIRO) 23 MAY 1995 (23.05.95) Figure 1.	1-14
X	US, A, 5,109,222 (WELTY) 28 APRIL 1992 (28.04.92) Figure 5, col.5, line 22 to col. 8, line 19.	1-6,8,10-14